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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No. 6536
JAMES HARNDEN et al.	Examiner: Jennifer M. Dolan
Application No.: 09/895,478	Technology Center/Art Unit: 2813
Filed: June 29, 2001	DECLARATION UNDER 37 CFR 1.131 OF RICHARD K. WILLIAMS
For: IMPROVED SURFACE MOUNT PACKAGE	
Customer No.: 20350	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I am a co-inventor of the above-referenced patent application.

Attached hereto as an Exhibit are six consecutive pages from my laboratory notebook, authored by me prior to June 2, 1999. These pages evidence invention of subject matter of pending claims of the above-referenced patent application, prior to June 2, 1999.

I hereby declare that all statements made herein of my own knowledge are true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Richard K. Williams

2/6/2004
Dated

1092 Norwich Ave.
Cupertino, CA 95014
60110973 v1

and it's continuous bend, in fact, demands the full dimension Xspace just to clamp the leads during the difficult bending operation. Without adequate clamping the plastic will be cracked.

To improve on the J-lead concept which is an old package as I remember, several key factors must be considered.

- The clamping area must be greatly minimized
- The stress during bending must be less so that the need for rigid clamping is reduced
- The width of the exterior lead may extend farther in the plane of the die pad than it does at the PCB surface, i.e. wider above the board than on the board.

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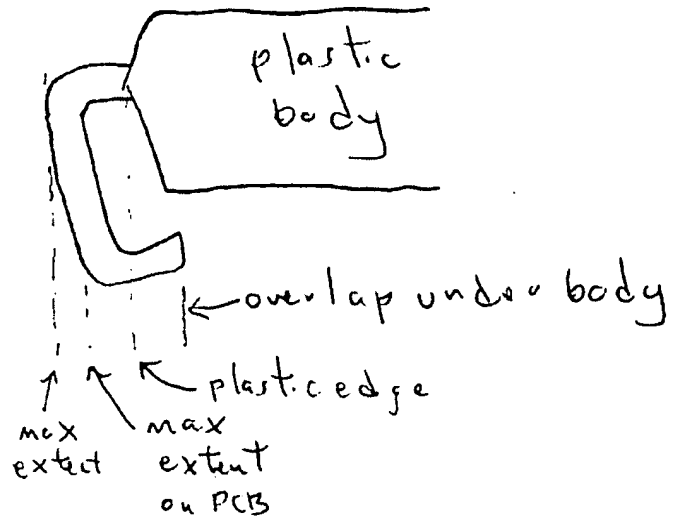
- The foot must bend under the plastic body, so that the plastic body is as wide as possible (i.e. a wide-body package)
- The bent portion should comprise a foot that forms the shape of an "L" rather than a J, with the foot extending under the plastic cavity (body)
- The L shaped foot should be bent only slightly, e.g. at 30° off the board, so as to provide adequate solder wetting (due to capilary action) but should not be steep enough to require added package height. In this regard the lead is an inverse gull wing, not a J-lead.
- The total height should extend above the board by no more than 1.1mm but 0.9 mm is preferred.

The resulting structure is then



So here you can see Xspace comprises the same area as Xbend and the exterior (protuding) portion of Xfoot, so the area efficiency is greatly enhanced. The lead on the side is therefore tilted, not vertical as it is in conventional gull wing and J lead packages

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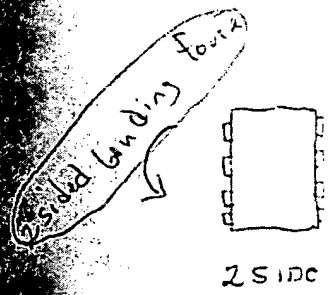

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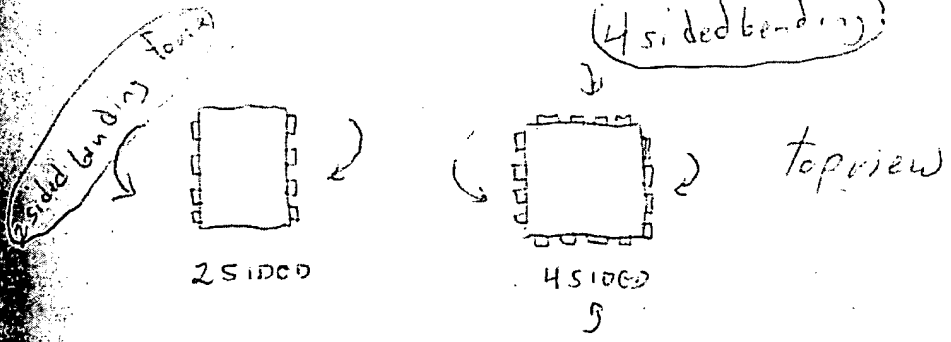
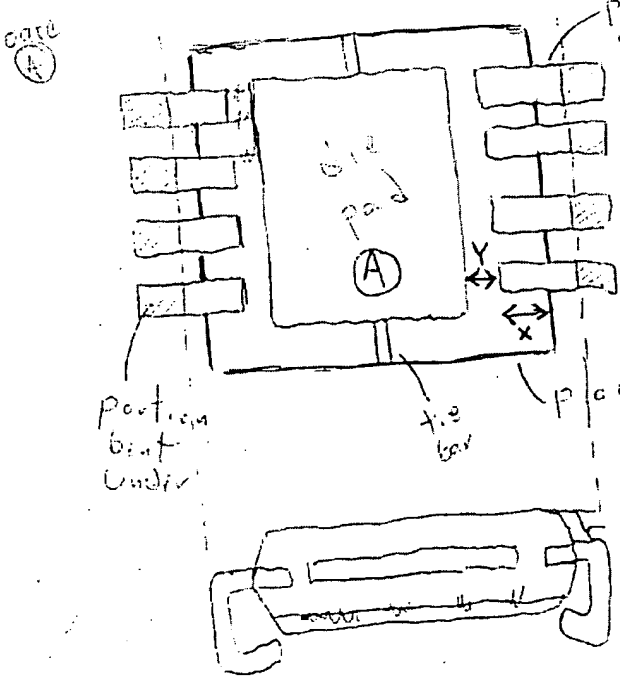
In regards to achieving high pin counts two factors must be considered ① the pin pitch, and ② the forming (lead bending) process. To keep costs low and achieve high yields a package with leads on two sides is much easier to implement in manufacturing than a package with ~~four~~ pins on all four sides.

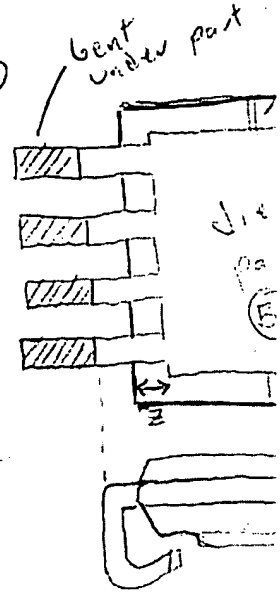


With easier bending, the pin pitch can be reduced to more state-of-the art design rules without complication. Ideally a copper lead frame can be used to improve thermal conduction.

Easier bending and a copper leadframe mean more pins can carry heat, especially if some of them are tied to the the die pad. Every pin tied to the die pad thermally also becomes electrically shorted to the pad, however, reducing the number of electrically independent pins. Some options are shown here for a variety of leadframes for a variety of



C version
max # of electrical pins (3), no thermal pins
plastic (higher thermal resistance)
same die for max elec version pins



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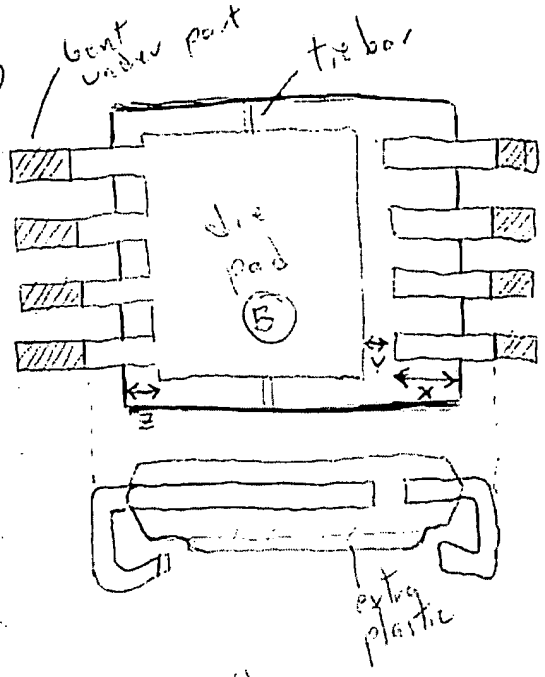

High Power Version

max # of thermal pins on one edge (4)

maximum die size (lowest Θ_{ja})

Selectrical connections

larger die than IC version

So if all the pins on one side are connected to the die pad (5) a larger die can be used (shown as A) because the required length to insure the lead is not pulled out of the plastic during lead forming or delaminated (doesn't sticks to plastic and doesn't lets moisture creep into the package) can be shorter. The minimum length X is longer than Z, maybe by a 2 to 1 ratio.